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# Denfield creek plan

1956

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CONSERVATION BRANCH  
ONTARIO DEPARTMENT OF PLANNING AND DEVELOPMENT



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DEPARTMENT OF PLANNING AND DEVELOPMENT

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THE HONOURABLE W. M. NICKLE, Q.C., MINISTER

A. H. Richardson  
Chief Conservation Engineer

# DENFIELD CREEK PLAN

1956

Toronto


1956



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Letter of Transmittal

May 15, 1956

Mr. J. A. Morrison,  
Chairman,  
Ausable River Conservation Authority,  
R.R.5, Parkhill, Ontario.

Dear Mr. Morrison:

I take pleasure in transmitting to you herewith a Little Valley Study on Denfield Creek, one of the tributaries of the Ausable River, for the purpose of encouraging the farmers and landowners in this valley to carry out a complete conservation program in the area, which might in future years serve as an example to other parts of the watershed for programs of a similar kind.

I would ask that you transmit this report to Mr Joseph E. Bryan, Chairman of the Farm Ponds and Farm Planning Advisory Board, for the consideration of his Board in particular; and assure him that we will give whatever help we can in assisting his Board to carry out this program in the name of the Authority.

Yours very truly,

A. H. Richardson  
Chief Conservation Engineer



# DENFIELD CREEK (BRANCH OF NAIRN CREEK)

## LITTLE VALLEY REPORT

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## RECOMMENDATIONS

### STATED OR IMPLIED IN THIS REPORT

1. That the Authority should do everything possible to bring about adjustment of land use to land capability in the valley. The map showing recommended use should be used as a guide. p. 37
2. That the Authority should promote in every possible way the planning of farms and to this end might consider employing a man to do the necessary interview work. p. 56
3. That in all matters pertaining to agriculture and farm planning the Authority should work in close co-operation with the local Agricultural Representative, and with the Zone Forester in matters pertaining to forestry. p. 51
4. That the Authority should promote one or more land judging contests in the valley. p. 51
5. That the Authority should endeavour to make sure that all farmers in the valley are aware of the personal and community benefits to be derived from conservation tillage and practices. p. 36
6. That the Authority should promote pasture improvement and renovation. p. 39
7. That the Authority should advocate and demand higher standards of farm pond construction and care. p. 45
8. That the Authority should press for more adequate woodlot protection and management. p. 46
9. That reforestation of private lands should be carried out as part of a farm plan rather than haphazardly and undirected. p. 46
10. That if speckled trout are desired brown trout should be restricted from that portion of the stream above the



Denfield dam, or the whole stream should be opened to brown trout. p. 48

11. That small log dams and stone deflector dams should be built to provide better habitat for fish to increase pool depth. The Authority could be aided in this matter by interested local clubs and service organizations. p. 49
12. That the Authority should obtain the assistance and co-operation of all groups who might have an interest in the improvement of the valley. p. 51
13. That the Authority should do all that it can to organize a community interest in the little valley with the object of making it a community of which all can be proud. p. 2



CHAPTER 1  
LITTLE VALLEYS

1. Introduction

A comprehensive survey of the Ausable River Valley was carried out by the Conservation Branch of the Department of Planning and Development in 1947, shortly after the Ausable River Conservation Authority was formed. The findings of this survey were subsequently published in report form and since that time a number of the recommendations made in the report have been carried out, either in full or in part. Much work has been done with respect to the provision or maintenance of recreational areas, the construction of farm ponds, the reforestation of land where this need is indicated, and so on.

While much has been accomplished with the aim of improving conditions in the valley since the report was published one important aspect has not received, perhaps, the attention it should: the reduction of soil erosion and the improvement of soil fertility and land conditions generally. This may be due to unawareness of the conditions which exist. Also, the very size of the watershed makes difficult the undertaking of an over-all program of agricultural land planning and improvement by the Authority.

2. Little Valleys

In order to provide the Authority with a more manageable unit on which a program of land improvement could be applied, the Conservation Branch carried out an intensive survey of one of the small tributary valleys in the summer of 1955. This valley is tributary to the Nairn Creek. It is hoped this report concerning the agricultural land will provide the Authority with sufficient basic information which will enable it to pursue a progressive policy of land improvement in an area which is not too large to deal with.



In addition to the size factor already mentioned, the selection and improvement of a small tributary valley has several advantages. In the first place the improvement of such a stream and its tributary lands is going to have a beneficial effect on the trunk stream. Given time and a number of improved valleys the effect would be magnified. Secondly, the accumulated effect of conservation measures is greater when they are applied on neighbouring properties. Often the success or failure of conservation measures on a farm will depend in part on what happens on neighbouring farms in the same watershed. A farmer will be little inclined to undertake such measures if he feels they will be ruined by malpractice or indifference of his neighbours. In the organization of community interest and in a display of leadership which would result in area development the Authority could play one of its more important roles. Thirdly, as new farming methods and ideas are introduced they can be applied to an area, with possible economies in operation and installation. Finally, such a group having a common interest could obtain and make use of machinery perhaps obtainable in no other way. Tree-planters and graders for grassed waterways might be cited as examples of the latter.

While the ultimate goal should be the improvement of the valley as a whole with every farmer and other land user co-operating with the Authority, which should give leadership and assistance where possible, the success or failure of the project depends on the individual farmer. He is the one responsible for the improvement of his own farm. He is also the one who has to cope with the unique conditions found on his farm. Nevertheless, the Authority can accomplish a great deal by bringing to the farmers the information they need to help them grow better crops and improve the condition of their land.



Land improvement does not necessarily entail the use of great masses of costly machinery which would be beyond the economic capacity of the average farmer. Where the need for such works is indicated most farmers have at hand nearly all the machinery they require. Many conservation measures require only a different method of operation, such as contouring, or an increased emphasis on the ones already used, such as increased use of fertilizer, the clipping of pasture weeds and so on.

Measures such as these do pay, particularly after they have been in use for a year or so. Not only does the land produce more and provide the farmer with more revenue but the run-off is controlled and the structure of the soil is improved. One study, made using a variety of implements in a considerable number of tests, found that contour cultivation resulted in average time savings of nearly 13 per cent and fuel savings of over 9 per cent as compared to uphill-downhill cultivation. Savings such as this are not to be ignored, particularly where the cost of conversion to such a system is small. On the Denfield **Creek** most of the land is suited to many of these relatively simple measures. The main need is a desire on the part of the farmer to do things the better way.

Initially it is important the farmer be made aware of these benefits and secondly that his farm be planned so that he can take advantage of them. Under a farm plan the land would be surveyed and rated according to its ability to produce and a plan of use established which would meet the needs of the farmer.\* Several farms in the area have already been planned.

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\* Farms are planned by the Soil Advisory Service, Department of Soils, Ontario Agricultural College, Guelph. Application for survey and plan may be made through the County Agricultural Representative.



### 3. The Denfield Creek Drainage Area

The area covered by the survey contains approximately 18,000 acres and lies along the eastern side of the Ausable River Watershed. The drainage area runs north-east south-west and is about  $8\frac{1}{2}$  miles long by 4 miles wide. It includes the hamlets of Denfield and Falkirk. The Village of Lucan lies just off the area to the north-east.

Physiographically the area is part of a rolling till and clay plain with associated till moraines and spillways. Surface relief is generally slight and the region is relatively undissected. At most, stream incision is little more than 25 to 30 feet and then only at the western limits of the watershed.

In elevation the watershed ranges from a little over 1,000 feet above sea level at the north-east to about 775 feet A.S.L. at the south-west. The regional slope is thus about 25 to 30 feet per mile.

The main stream through Falkirk and Denfield flows throughout the year although the volume in summer is small. In mid-summer nearly all of the tributaries are dry and many of them have been converted into open drains. These latter are a common and necessary landscape feature associated with the imperfectly and poorly drained soils of much of the till plain.

In this section of the Ausable River Watershed the bedrock is nowhere exposed at the surface; the layer of unconsolidated materials over the shale and limestone is fairly thick.

### 4. How the Valley Was Surveyed

During June, 1955, several crews were engaged in the survey of the valley. Each crew was allotted a portion of the watershed and all the land was covered on foot with visits being made to every field.



During the survey a number of observations were recorded, the data being plotted on air photographs of the area. These show the field pattern, the field boundaries, extent of woodlot and so on, and their use greatly facilitates survey work of this nature. All land uses for the crop season of 1955 were recorded on the photographs by means of appropriate symbols. In the same manner physical land conditions were recorded to a minimum of four acres. These included the delimiting of soil types, an estimation of erosion, the slope of the land, the degree of stoniness or boulderiness, and the extent and size of gullies. The location of waterbodies, watercourses, springs, seepage areas and drainage ditches were noted.

During the survey many farmers and others were interviewed with the object of obtaining more complete information on questions of land use and soil problems and capabilities.

With the completion of the survey the information obtained was transferred from the air photographs to vellums and the various acreages assessed by planimetering. From the data gathered regarding present land use and physical land conditions the capability of the land was appraised. This is expressed in the map of Recommended Use which accompanies this report.



## CHAPTER 2

### PHYSICAL FEATURES OF THE DENFIELD CREEK WATERSHED

#### 1. Physiography

Some few thousand years ago, perhaps 15,000, this part of Ontario was covered by thick masses of continental ice. The ice was not, in its later stages at least, a continuous cover, but consisted of several lobes. A series of advances and recessions of the ice front over a considerable number of years and the eventual disappearance of the ice, together with various events associated with it, led to the formation of most of the major landscape units that we see in Southern Ontario today. Directly or indirectly attributable to the ice and its movement are the drumlin fields, sand and clay plains, spillways, till plains, moraines, beaches, shorelines and other landforms which are to be found. One or two of these are significant to the area under discussion and have much to do with the agricultural activity carried on.\*

The valley of the Denfield Creek lies along the western boundary and near the south-western corner of the extensive till plain which occupies so much of the land surface of south-western Ontario. In this section the till plain is undrumlinized and divided into sections by several moraines and spillways.

Two moraines cross the watershed, the Lucan and the Seaforth. The former is the long, narrow relatively low ridge which runs more or less north-south just to the east of Lucan. It forms the easterly headwater area of the stream. The Seaforth moraine is topographically similar and has the same directional trend. It is located just to the west of Denfield. The stream cuts through the moraine here,

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\* Indispensable to an appreciation and understanding of the development of the scenery of Southern Ontario is "The Physiography of Southern Ontario" by Chapman, L. J., and Putnam, D. F. University of Toronto Press. 1951. (maps).



and the combination of a relatively narrow valley, adequate stream gradient and sufficient flow at one time led to the establishment of a number of grist and other mills. It is doubtful if these mills could be sustained on the present flow.

Paralleling the Seaforth moraine on its eastern flank there is a glacial drainage channel, a spillway, now occupied by several small headwater streams, among them two tributaries to the Denfield Creek.

Just outside the western limits of the watershed sand and clay plains are to be found. The former lies to the north of Nairn and the latter to the south.

Unlike many moraines the portions of those within the watershed are not particularly stony; they are, in fact, quite free of bouldery material. The till of which they are composed is heavy and a pale brown or brownish-gray in colour. Topographically the moraines present a characteristically tumbled aspect but one that is much subdued. Surface and internal drainage of the moraines is generally good but poorly drained low spots are to be found.

The portions of till plain between the moraines are flat to very gently rolling or sloping and the till itself is, generally speaking, but little different from that found in the moraines. This combination of level terrain and heavy till combines to create a soil condition of imperfect or poor drainage.

Most of the soils in the watershed have been placed by the Ontario Soil Survey in the Huron catena. The well drained Huron soils are found on the moraines and in some sections of the plain; the imperfectly drained Perth and poorly drained Brookston are mostly on the plain. Artificial drains, normally so common a landscape feature where Perth and Brookston soils dominate, are less prevalent in this area.

On the basis of soil material there seems to be some justification for believing that during the period of ice recession, and perhaps for some time afterwards, a fair amount



of water reworking of the till took place. Surface silt and clay layers, attributable to water work, are fairly common although not usually deep. The influence on agriculture appears to be slight but the silty phase is often sufficiently marked to warrant differentiation as Huron silt and Perth silt; both are loams.

(a) Till

This material, often called boulder clay or drift, is formed by an ice sheet and consists of pulverized rock flour and angular stones of various sizes. Depending on the nature of the source rocks or unconsolidated materials till may be either heavy, medium or light. Shales worked over by the ice would tend to produce a heavy till while sandstones would produce a light till.

Tills may vary widely with respect to material content and even in small areas there may be differences in make-up from one location to another. A till may, for instance, contain shale as a dominant constituent but also include various amounts of limestone, sandstone, granite and so on. Depending on conditions of mixing a till may be classed as loamy.

The till moraine is similar to the till plain from the point of view of the organization of the material comprising them but usually the topography is more tumbled, the slopes steeper, and the till itself coarser and much more bouldery. The till moraine is formed at the rim of the ice, rather than underneath it as is the case with the till plain.

For the most part the land within the watershed is rather undissected; only downstream from Denfield is the valley at all deep. In some sections, where incision has taken place to some depth, off-shooting gullies and steep cut banks produce almost the effect of badlands. Such areas are very limited in extent, however. The main stream itself carries rather little water during mid-summer when most of the tributaries are dry; in part this is due to the construction



of artificial drains which enable the surface and soil waters to escape rapidly.

## 2. Soils

### (a) The Soil Profile

The development of any particular soil is a matter which involves a number of factors, some of which may be of more importance than the others. Type and composition of the parent material, surface slope, soil drainage, and climate may be cited as examples of some of these variables. In any single instance all of these factors operate together and interlock in such a way that, if undisturbed or unchanged, they produce, in time, a soil possessing certain recognizable characteristics. Occasionally, where the magnitude of change has been considerable enough, one will find two soil profiles in the one soil mass. In a case such as this there has been insufficient time elapse for the original profile to disappear. The conditions which operate to create soil profiles are dynamic and the soils are thus in a constant state of flux, but the changes in the profile usually take place very slowly.

If a vertical cut is made to a depth of three or four feet through the soil it will be seen that the cross-section is marked by a layering, each layer, or HORIZON, possessing certain characteristics of colour, texture, structure, organic content, acid reaction and so on. Together these horizons make up the soil PROFILE. The depth of the profile is variable, in some soils a foot or less and in others several or many feet. On the Denfield Watershed the profiles are usually about two feet or less in depth. In many places the profiles are quite well defined, particularly the Huron loams.

Depending on drainage conditions several distinct types of profile may be found. The following is a generalized description of a virgin, well drained Gray-Brown Podzolic soil



such as might be found in Southern Ontario.

HORIZON

- A<sub>0</sub> - Partially decomposed litter from deciduous trees.
- A<sub>1</sub> - Dark grayish-brown to very dark brown mineralized Humus layer - loose and friable and slightly acid in reaction.
- A<sub>2</sub> - The leached horizon, yellowish to yellowish-brown to gray in colour. The iron, lime, organic matter and clay have been washed out and the reaction is acid.
- B - The horizon of accumulation, containing a high proportion of clay and sesqui-oxides. Usually the colour is dark or reddish-brown while the structure is blocky or nutlike. In reaction it is usually neutral to slightly acid but the lower portion of the horizon may contain some free carbonates.
- C - The unweathered, calcareous parent material, usually gray or brownish-gray in colour.

In no case are the horizons separated one from the other by a sharp break; there is always a transition, in some cases greater than in others.

Profile complexity also varies. In some soils not all horizons are represented, or they may be poorly developed. Also, the horizons may vary considerably from soil to soil in thickness; some have a thin A<sub>2</sub>, some have a thick A<sub>2</sub>, and so on.

When speaking of the soil horizons the A is considered to be the topsoil, the B the subsoil, and the C the parent material. In a poorly drained soil such as the Brookston the A<sub>2</sub> and B horizons may be missing or poorly developed and a G (glei) horizon exhibited. The latter is often blue or bluey-gray in colour and marked by rusty mottling.



As plant material decays it is gradually incorporated into the A horizon as humus by the action of earthworms, micro-organisms and so on. During this process certain acids are formed and these are washed downwards by the rain. Partly as a result of this acidic solution, lime, iron, clay colloids, and organic matter are leached out and carried downward to be redeposited, in part, in the B horizon. The B horizon thus has a rather high clay content and is dark-brown to reddish-brown in colour. Depending on their thickness several horizons may be mixed together when cultivated to form an A<sub>c</sub> (cultivated) horizon.

Under conditions of a fluctuating water-table near the surface a soil may be considered to be imperfectly drained. Such a soil may possess a thicker A<sub>1</sub> horizon and at the same time the A<sub>2</sub> or leached horizon may be less well developed. Field identification is guided by mottling (rusty streaks and patches) appearing in the lower part of the A<sub>2</sub>, and in the B horizons.

In addition to the Gray-Brown Podzolic and Dark Gray Gleisolic (e.g. Brookston) two other soils are to be found on the watershed: muck and bottomland.

In the case of the muck the drainage has been so poor for so long that normal profile development has been unable to take place. Where muck is found (chiefly in a part of the spillway to the north of Denfield) it is black in colour, woody, and shallow, although in places it may be up to three feet deep.

Bottomland, a land type consisting of soils made up of alluvium, is found along the stream courses where periodic inundation takes place. This flooding leads to the deposition of various mixtures of sand, silt, clay and gravel. Soil drainage is usually imperfect to poor and soil profile development is most often non-existent.



(b) The Soils of the Watershed

Nearly all of the soils in the watershed have developed in parent materials laid down during the last ice age. It has already been mentioned that the parent materials consist chiefly of heavy tills. A small acreage of soils within the valley have developed on gravels laid down by glacial meltwaters, and an additional small acreage on medium textured till.

A group of soils developed on the same type of parent material and possessing similar horizon development and characteristics is classed as a soil series. Type differentiation within a series is based on the texture of the surface soil. There is thus a Huron clay loam and a Huron silt loam. Huron indicates the soil series and, with the exception of the texture of the surface soil, these two soil types have the same differentiating characteristics.

Where soils have developed on similar parent materials but differ in profile characteristics due to drainage or relief, then classification may be done on the basis of the catena. In terms of drainage there may thus be three series in the catena; the well drained, the imperfectly drained, and the poorly drained members. In the Huron catena the Huron series is the well drained member, the Perth series the imperfectly drained member, and the Brookston series the poorly drained member. For convenience a catena is usually identified by the name of the well drained member.

It has been mentioned already that the largest acreage of soils in the watershed belongs to the Huron catena; in fact, these soils occupy about 17,258 acres, or 96.4 per cent of the area. The balance is taken up by soils of the Guelph catena, the Burford catena, and muck and bottomland. Table I summarizes the situation found on the survey.

Because the acreage involved for some is so small there is little need, at this point, to examine or describe in detail the profiles for the various soils. For



those interested copies of the soils map for Middlesex County are readily obtainable through the Agricultural Representative; the same is true for the soils descriptions, all of which are contained in Report Number 15, Soil Survey of Perth County. Some emphasis may, however, be placed on the soils of the Huron catena.

TABLE 1

Catena	Soil	Acres	Total Acres	Per Cent	Total Per Cent
Huron	Huron clay loam	5,814	17,258	32.5	96.4
	Huron silt loam	3,811		21.3	
	Perth clay loam	4,059		22.7	
	Perth silt loam	2,951		16.5	
	Brookston clay loam	623		3.4	
Guelph	Guelph loam	33	123	.2	.7
	London loam	90		.5	
Burford	Burford loam- Shallow phase	33	33	.2	.2
	Muck	89	89	.5	.5
	Bottomland	360	360	2.0	2.0
	Water and misc.	41	41	.2	.2
Totals		17,904	17,904	100.0	100.0

For the most part there is rather little difference to be found between the Huron and Perth soils and under certain conditions there is difficulty in distinguishing between them. Normally the topography of the Perth is gentler than for the Huron and the incidence of erosion less. The Perth profile, too, is somewhat shallower and less well developed than that of the Huron; and the horizons are thinner, except for the A<sub>1</sub> which tends to be slightly thicker, perhaps as a result of gentler terrain and restricted drainage. In



certain other respects also these two profiles are much alike.

The chief difference between the two lies, as already mentioned, in the question of soil drainage. In this respect the Perth is classed as imperfect and close examination of the profile discloses mottling, due to a high and fluctuating water table, in the A<sub>2</sub> and B horizons. This mottling is displayed in the form of rusty streaks and blotches.

The Huron soils are fairly productive and under natural conditions are better for most field crops than the Perth. The adaptability of the Perth soils is greatly improved when adequate tile drainage is installed, at which time they are nearly equal in productivity to the Huron. An advantage of the Perth, as already mentioned, is a lower susceptibility to erosion.

Because of the rather gentle terrain there is an absence of road cuts in the area sufficiently deep that good soil profiles may be obtained. Some of the best examples were found along fencerows where cultivation has never taken place; these were examined using an auger and/or spade.

Although there is some differentiation in profile development from place to place, particularly in depth of profile, the following brief description of the Huron clay loam may be taken as typical.

The Huron is only a moderately deep soil and the calcareous, light brown to gray-brown clay till is reached at a depth of from 17 to 25 inches. The till tends to be rather massive and hard and may be only slightly stony to quite stony. The A<sub>1</sub> horizon, the humus-rich layer, is quite dark in colour, friable, and very nearly stone-free to stone-free; it may be up to 5 inches in thickness. The underlying A<sub>2</sub> horizon may be up to twice as thick and is somewhat yellowish-brown in colour; it is normally stone-free. The B horizon is a hard, blocky-structured clay and very nearly stone-free. The A<sub>1</sub> and A<sub>2</sub> horizons are very slightly acid in reaction. The soil is typical of the Gray-Brown Podzolics.



The Brookston clay loam belongs to the Dark Gray Gleisolic group of soils and is the poorly drained member of the Huron catena; there is also a silty phase not found in this area. Typically, the Brookston topography is quite level and erosion is negligible. The soil is often found in depressional areas as well as in the headwater sections of tributary streams. In some places it has been cleared for pasture, often unimproved and replete with weeds and scrub, and in others has been left in woodlot. Where adequately drained the capability of this soil is greatly improved.

The A<sub>1</sub> horizon of the Brookston is deeper than in the other two members of the catena and may reach a depth of up to 10 inches; normally the horizon is a little thinner than this. It is a friable black clay loam and is usually stone-free. The G (glei) horizon underlies the A<sub>1</sub>, and the bottom may be up to 12 or 14 inches below the surface. It is gray-brown in colour, almost olive at times, and is hard and tough, or sticky, according to moisture conditions. The parent material is a calcareous, slightly to fairly stony, clay till.

The mucks are the result of poor drainage conditions operating over a long period of time. These conditions have prevented the complete decomposition of the organic debris, with the result that it has accumulated over the years. The persistence of the water also inhibits the activity of aerobic bacteria, earthworms and fungi.

The muck is quite dark in colour, is usually acid, contains a minimum of mineral material, and may be up to 3 feet deep in some places. The land use is usually woodlot or scrub. The underlying mineral material is variable although sands and clays are common.

Bottomland has been discussed at sufficient length in the previous section. It should be noted, however, that depending on the width of the section in question it was sometimes found necessary to include, for mapping purposes,



the adjacent valley slopes. This was made necessary by the scale of mapping and has some bearing on the recommendations found on the map accompanying this report.

(c) Soil Erosion

Many people are possessed of the misconception that erosion of the land, that is, the translocation of soil materials from place to place by the natural forms of wind or water, can be stopped completely. This is impossible except, perhaps, over small areas, for relatively short periods of time, and under certain conditions. Through the ages erosion of the land has taken place, moulding it into the scenery we see today. Under natural conditions this erosion is a very slow process and long years are required to alter the landscape appreciably. We call this form of erosion "geologic" erosion.

Under natural conditions the face of the earth is masked by a cover of vegetation and it is this cover which is chiefly instrumental in retarding run-off and slowing down erosion by wind and water. Because of the slow rate of erosion the soil, as seen in the profile, is not greatly affected by it and the process of soil building is easily able to keep pace with it. While conditions remain more or less the same the loss of a fragment of surface soil is offset by an increment from below as the parent material weathers and is incorporated into the soil. Under conditions such as this nature is, by and large, in balance.

When the land is cleared for cultivation or used for grazing, however, this picture may be greatly changed: the protecting cover of vegetation is removed or reduced; cultivation may be carried on up and down the slope and surface water enabled to flow over the land more easily; the structure of the soil changed for the worse and organic content lessened with the result that the soil's moisture absorptive capacity is impaired. All of these changes can easily produce, in a rather short time, a less productive or even a ruined soil.



Such erosion is called induced or "accelerated" erosion. It is this erosion that the conservationist is concerned about and which every farmer should be aware of.

Some soils erode more readily than others and the same soils under different forms of land use may show vastly different amounts of erosion. There are also other factors which affect the rate of erosion: surface slope, topography, intensity of land use, rate of rainfall and the physical condition of the soil. For these and other reasons a farm plan based on conditions peculiar to the individual farm is desirable to control erosion.

In Ontario the removal of soil by erosion is accomplished by wind and water; the former is of importance in only a few areas, chiefly those of light soils. Erosion by water is much more widespread although, as intimated, it is more damaging on some soils than on others.

When the surface run-off is concentrated into channels which are unprotected, or inadequately protected, gullies may develop. This is the most spectacular form of erosion in Ontario and a gully can grow quickly to the detriment of the land and the farmer. Fortunately this form of erosion is not common on the present watershed but some are found cutting back through streambanks. Run-off channelled in an unprotected field, unprotected tile drain outlets, and channels formed through cattle always using the same path are among the contributing factors leading to gully erosion.

At the start a gully may be insignificant but it can become large very rapidly. Small rills which are found on the slope of a cultivated field after a heavy rain and which can be covered over at the first cultivation are danger signals every farmer should heed.

Sheet erosion is much less spectacular but is dangerous because it is so widespread and most often goes unnoticed. This form of erosion usually takes place relatively slowly, but a whole field may be affected, with the



result that the humus-rich portion of the soil, together with its store of available nutrients, is removed. Much of this erosion takes place during summer storms, just at a time when crops need the moisture which is flowing over the surface of the land into the streams. A reduction in the run-off would thus prove directly useful in at least two ways: reduced erosion and increased moisture supply for crops.

Many measures may be adopted to control run-off and reduce erosion. Land kept under a permanent cover of grass or trees and properly managed may erode very little. The same may be true on level lands regardless of the form of use, although, of course, the land may become less productive unless soil management practices are adequate. Soil-building rotations, the use of cover crops and fertilizers, contour tillage and grassed waterways are among the measures that may be used.

(d) The Estimation of Erosion

There are a number of ways of determining whether erosion has taken place and the amount. The effect of erosion may often be easily seen in poor crop response due to drought. On slopes or knolls where the A and/or B horizons have been removed, the soil is less able to absorb moisture, and the crop may be thin and weak. Where erosion has been severe, the grayish parent material may be seen at the surface. A patch with an excessively stony surface may also be a sign of severe erosion and reflect the removal of the finer soil constituents. Erosion of this severity is relatively rare on the watershed.

Where observations such as this may be made, other evidence is also usually available: sediment may be seen to have accumulated at the bottom of a slope; soil may accumulate on the uphill side of a fencerow, while the downhill side is cut away.

To get a more certain determination of the degree of erosion the soil profile must be examined. It is



usually possible to find a good profile of a virgin or nearly undisturbed soil in woodlots and along old fencerows. Such a profile may, for instance, exhibit one foot of topsoil ( $A_1$  and  $A_2$ ) and two feet of subsoil (B). On an adjacent cultivated slope of the same soil type and on which erosion is suspected, there may be only 6 inches of topsoil over the subsoil. In such a case it would be fair to assume that something like 6 inches of topsoil had been eroded away. In another case one might find the subsoil exposed at the surface and the parent material at a depth of only 12 inches. All of the topsoil and one half of the subsoil, something like 2 feet of material, would thus have been removed.

If the recognition of horizons by colour or texture is difficult, a simple chemical test can be used to aid in erosion estimation. A dilute solution of hydrochloric acid produces an effervescence when applied to soil containing free carbonates. In the imaginary virgin profile mentioned above a fizz would be obtained at 3 feet at the start of the lime-rich parent material. On the severely eroded site the same result would be obtained at 1 foot. If the surface soil effervesced it would indicate that all of the topsoil and subsoil had been removed. A note of caution should be made, however, in that some soils may be found where other horizons naturally possess sufficient free carbonates to produce a reaction.

(e) Soil Erosion on the Watershed

Because of the gentle topography and a fairly heavy emphasis on grass as a form of land use, soil erosion on the watershed is not as severe as it might otherwise be. Combined with a decreasing humus content and lowered fertility it is, however, serious enough. The following tables show the acreages of the several watershed soils affected by the various degrees of erosion, and also the acreages of the watershed classed according to slope. The latter table is self-explanatory but the information contained therein underlines the remarks made previously regarding the topography of the area and also bears relation to the degree of erosion found.



In addition 89 acres were classed as muck and 360 acres as bottomland. No attempt was made to estimate erosion for these types and in many cases, if not most, they were receiving material eroded from surrounding slopes rather than losing it.

It must be remembered that the data in this table recognize average conditions. There are many small areas where erosion is severe; at the scale of mapping these were too small to be included. It should also be remembered that, in the above classification, amount of material removed will vary from soil to soil. One-third of the topsoil removed from one soil may involve much less material than one-third from another soil because of the differences in depth of profile.

(f) Soil and Surface Drainage

The lack of adequate soil drainage is one of the most important features of the area and a large acreage is affected. To gain relief so that a wider variety of crops may be grown and a more abundant yield obtained it is essential that such land be drained artificially. To a certain extent this has been done and there are numerous open drains and tile underdrains. An expansion of this program is indicated except on land where the cost of draining would be out of proportion to the benefit gained. Some of these areas are at the headwaters and it would be desirable to leave them as they are.

The inability of crops to grow and produce on land with restricted drainage is due primarily to two things. In the first place the crops grown in the watershed are constitutionally unable to grow in water or in a water-logged soil. Secondly, although seeds may germinate, the roots develop and the plants begin to grow in the drier zone above the water table, their later growth may be restricted by drought. This is because the plants cannot root deeply in



the early, wetter part of the season. As the drier, hotter summer comes on the water-table drops, sometimes quite rapidly, and the crop is starved for water because of the shallow root development. Too, the heavy soils, such as the Perth and Brookston, become hard and resist root penetration as they dry out.



TABLE II  
SOIL TYPE AND EROSION

SOIL TYPE	DEGREE OF EROSION					Total Acres	Per Cent
	0	1	2	3	4		
Huron Clay Loam	184	3,712	1,316	579	23	5,814	33.3
Huron Silt Loam	291	3,093	311	107	9	3,811	21.9
Perth Clay Loam	256	3,203	539	59	2	4,059	23.4
Perth Silt Loam	409	2,315	192	35	-	2,951	16.9
Brookston Clay Loam	582	41	-	-	-	623	3.6
Guelph Loam	-	17	16	-	-	33	0.2
London Loam	-8	73	9	-	-	90	0.5
Burford Loam - Shallow Phase	-	26	-	5	2	33	0.2
Total Acres	1,730	12,480	2,353	785	36	17,414	
Per Cent	9.8	71.8	13.7	4.5	0.2		100.0

Degrees of Erosion

- 0 - No significant erosion
- 1 - Less than 1/3 topsoil removed
- 2 - 1/3 - 2/3 topsoil removed
- 3 - 2/3 topsoil and less than 1/3 subsoil removed
- 4 - All topsoil and less than 2/3 subsoil removed



TABLE III  
SLOPE CLASSES AND ACREAGES

Slope Group	Per Cent Slope	Acres	Per Cent
A	0-2	10,168	56.7
B	2-6	3,175	17.7
C	6-10	182	1.0
D	10-15	12	.1
E	15-20	28	.2
F	20-30	17	.1
M)	0-7	3,787	21.2
N) - Hummocky	7-15	66	.4
P)	15-25	68	.4
Miscellaneous - Slopes Not Mapped		401	2.2
Totals		17,904	100.00



## CHAPTER 3

### LAND USE

Basically the watershed is a dairy products and beef producing area, and most of the land is devoted to the crops suited to these purposes. Cash cropping extends into the area, however, and at least 650 acres were thus used in the crop season of 1955. No attempt was made to determine what part of the corn crop was planted as a cash crop, but the acreage is believed to be small.

Most of the dairy cattle are Holsteins (there are over 500 dairy cattle on the watershed, for an average per dairy farm of about 19 head), and although a small amount of whole milk is shipped to the London market, the larger part of the milk produced goes to the factory at St. Marys. There is no particular relationship between dairy cattle distribution and land conditions. Most of the dairy cattle are confined to the eastern half of the watershed, and it is believed this is related more to the factor of distance (from the consuming centres) than to anything else. It might be noted that this area forms part of the western border zone of the Western Dairy Belt, as defined by Putnam.\*

At the time of the survey there were approximately 1,880 head of beef cattle (mostly Hereford) within the watershed plus an undetermined, though relatively small, number of sheep, horses, hogs and fowl. There is a greater emphasis on hogs where dairying is the main endeavour. Many of the beef cattle are brought in from the West for improving. When they have reached the desired condition, they are shipped to the Toronto market and to other centres. A few are slaughtered locally.

Taking the watershed as a whole, it is estimated that there is only one head of cattle (of all ages) for

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\* Putnam, D. F. Canadian Regions: A Geography of Canada, (see map, page 241). Dent. 1952.



every 6.9 acres of farmland. Although this is near the Ontario average, it is below the average for the adjacent counties and townships. There seems to be no particular reason why the cattle population should be this low.

It has been revealed already that livestock are the bedrock on which the economy of the watershed rests. Verification of this is found in the survey statistics, which show that approximately 8,400 acres are in pasture, an additional 2,050 in hay, 3,600 in fall and spring grains and 1,000 in corn.

The following table summarizes the land use conditions found during the crop year of 1955.

TABLE IV

Land Use	Acres	Per Cent
Pasture	8,407	46.9
Hay	2,059	11.5
Spring grain	2,752)	20.4
Fall grain	898)	
	3,650	
Corn	1,025	5.7
Potatoes	14)	3.5
Turnips	37)	
Sugar beets	146)	
White beans	404)	
Soya beans	17)	
Fallow	202	1.1
Orchard and market garden crops	76	.5
Forest	238)	7.7
Forest - pastured	761)	
Forest scrub	7)	
Forest scrub - pastured	370)	
Other (urban, farm buildings, etc.)	491	2.7
TOTALS	17,904	100.0



A large portion of the pasture is in an unimproved state, and an unduly large amount of it is covered by weeds, hawthorn and various shrubs. In some fields the hawthorn is quite large and has obviously been there for a number of years. Viewing the pasture situation as a whole, it is fair to say that much of the land devoted to this use is not doing the job it should. An important phase of the Authority's program in the improvement of this valley might well take the direction of promoting pasture improvement. After all, and perhaps contrary to the opinion of many, livestock products are by far the most important products of our Ontario soils, and measures which will improve the productivity of these soils through better management will be to our advantage.

Although the acreage devoted to the several vegetable cash crops is small and forms only 4 per cent of the watershed, it is fairly important.\* In all but one or two instances these crops are subsidiary to the main farm pursuit, and in any one case usually a field or less is involved. Also, their growth is not particularly localized but is spread throughout the watershed. Of all these crops, that of white beans takes up the largest acreage (404), with sugar beets running well behind (146). The acreages in potatoes, turnips and soya beans are small in each case. Aside from the fact that some of these crops are leguminous and promote soil-building in a direct way, the chief interest from the conservation point of view is that they be restricted to level or near level land, that they be grown not too often on the same field and that, where sloping land is used, cultivation be on the contour.

These latter remarks also apply in part to corn, which uses about 5.7 per cent of the watershed acreage, but

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\* This includes the land devoted to farm orchards, the products of which do not enter commerce. The acreage involved is small and the trees are not well looked after.



which is a feed crop rather than a cash crop. One instance was found where a 40-year pasture had been broken and cultivated to corn three years in a row and a fourth year in corn was contemplated. A "rotation" of this sort is not recommended.

During the period of the watershed survey a brief special study was carried out respecting certain soil management practices. Altogether 19 farms were visited and special attention was paid to 2 fields on each farm. These may be designated "rotation units", for a total of 38 units. One outstanding fact brought to light in this study is that there is a wide diversity of crop rotations; from a soil conservation point of view perhaps "crop sequences" would be a better term. Many of the rotations are so contrived that 3 or more years of grain or intertilled crops follow one another before a cover of grass is installed. The most extreme example found was 6 years without grass. In this case there were 2 years of corn, followed by 1 each of spring grain and summer fallow, followed by 2 years of fall grain. The case of 4 successive years of corn has already been mentioned.

Of the 38 units, 18 carried rotations involving not more than 2 years without a grass cover, 5 had 3 years without grass, 10 had 4 years without grass, 4 had 5 years without grass and 1 had 6 years with no grass. It may thus be seen that in this sample, fully 40 per cent of the fields were carrying rotations lacking in a high level of soil-building crops.

The erosion picture for the watershed is as good as it is chiefly for two reasons: (a) the fact that so much of the land is devoted to pasture and woodlot, and (b) the gentle slopes which prevail throughout. Under other circumstances land use practices such as these would no doubt have led to erosion more severe than is generally found. Much of the soil does, however, possess poor or inferior structure,



which is aggravated by the heavy nature of the soils and which can only be remedied by better practice and a greater emphasis on grass as a crop. The large acreages in more or less permanent vegetation serve to mask the exploitation of the more frequently cultivated fields. An important function of the Authority should be that of pleading and promoting the case, in co-operation with the County Agricultural Representative, for better basic practices, such as rotations adapted to the land and the individual farmer's need.

Some attempt was made to gather information regarding the amount, distribution and state of tile under-drainage in the watershed. The attempt was unsuccessful for a number of reasons, chief of which are the facts that many have been in a long time and are inoperative, and new land-holders have no knowledge of such drains. It is clear, however, that a great deal of the land has been tile-drained in the past and that many of these drains are not working. The need for drainage on "sad land" is appreciated by most farmers, many of whom have made plans to install tile where needed. A number of starts were made in this direction during the 1955 crop season. Also, of course, there are a considerable number of open drains, some of which have not been well constructed.

Although much of the land is imperfectly or poorly drained, there is a definite lack of accessible water during the summer for stock watering. This has led, largely under impetus from the Ausable River Conservation Authority, to a widespread program of farm pond construction. Most of these ponds are of the dug-out variety, and they are well suited to local conditions and needs. There is still a need for ponds of this type, and there are many places where they could be built easily and cheaply.

Weeds are an important but non-productive feature of the landscape of the area. They are, perhaps, most common on the permanent pastures and range from wild carrot



(Queen Anne's lace), tall buttercup, chickweed, dandelion and bindweed, to hawthorn and ragweed. There are many others, of course, but these are fairly common and a greater effort should be made to eradicate them.

The distribution of forest cover on the watershed is the outcome of several factors. A large amount of the woodland is found along the various watercourses where physical land conditions are such as to preclude their use for much else. This kind of use on this type of land is desirable, and there is additional cleared acreage being used for poor pasture which would be better reforested. Forest cover is also found on some of the poorly drained lands; often these are headwater areas which are difficult to drain or which would be uneconomical to drain. On many farms the woodland occupies the less accessible "back acres", even though the land may, in some cases, be better than land nearer the farm buildings. The acreages devoted to forest are detailed in Table IV. Further discussion of the woodland of the watershed will be found elsewhere in this report.



## CHAPTER 4

### LAND CAPABILITY AND RECOMMENDED LAND USE

#### 1. Land Capability

Before the land of a watershed can be planned for the purposes of soil and water conservation, it must first be surveyed to determine its use capability and then classified accordingly. The system of classification used is similar to that used by the Department of Soils, Ontario Agricultural College, in the planning of farms.

In classifying the lands of the watershed, several questions were kept in mind: (a) Was the land suited to the type of agriculture prevailing and if so, could it be tilled without the risk of erosion? (b) If erosion was a restricting factor, how great a risk was entailed in devoting the land to continual cultivation? (c) Was the safe use of the land limited to the production of permanent vegetation and if so, should the cover be grass or forest? (d) What was the position respecting soil drainage? (e) To achieve minimum risk should the land be cultivated only part of the time? There were also other questions which entered into the construction of the map of recommended use which accompanies this report.

In assessing the suitability of a piece of land for agricultural use, the piece of land in question is rated according to one of the four following categories:

- A - Suitable for cultivation
- B - Suitable for only occasional cultivation
- C - Suitable only for permanent vegetation and unsuitable for cultivation
- D - Not suitable for cultivation or for commercial grazing or forestry.

Within these broad categories various classes of land are recognized.



A - Suitable for Cultivation

- Class I - Without any special practices over and above what is considered to be good farming for the area. This land may be continuously cultivated with safety and will produce good crops for an indefinite period.
- Class II - Requires moderate restrictions in use and more specialized conservation practices to produce good yields with minimum risk to the land.
- Class III - Needs intensive restrictions in use to provide good crops on a sustained production basis with minimum risk to the land.

B - Suitable only for Occasional Cultivation

- Class IV - Best used for permanent vegetation but may be safely cultivated occasionally to certain crops.

C - Suitable only for Permanent Vegetation

- Class V - Normally uncultivable because of restricted drainage and is best suited to permanent vegetation. No special practices or restrictions are required.
- Class VI - Requires moderate restrictions in use.
- Class VII - Needs severe restrictions in use.

D - Not Suited to Cultivation or Commercial Grazing or Forestry

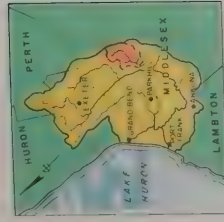
- Class VIII - Includes areas of rock outcrop or marsh which do not lend themselves to cultivation or commercial grazing or forestry.

2. Recommended Land Use According to Use Capability

The land use capability classes may be converted into classes of recommended use by indicating which special practices and restrictions are required for each type. The recommended classes are indicated by adding the symbols C, R or D to capability classes II and III and T or P to class IV. On classes V, VI and VII, recommendations are given as needed. No special practices are required on class I land and normally no restrictions are placed on use.

The symbol C is applied to land where the capability has been reduced by erosion which can be corrected



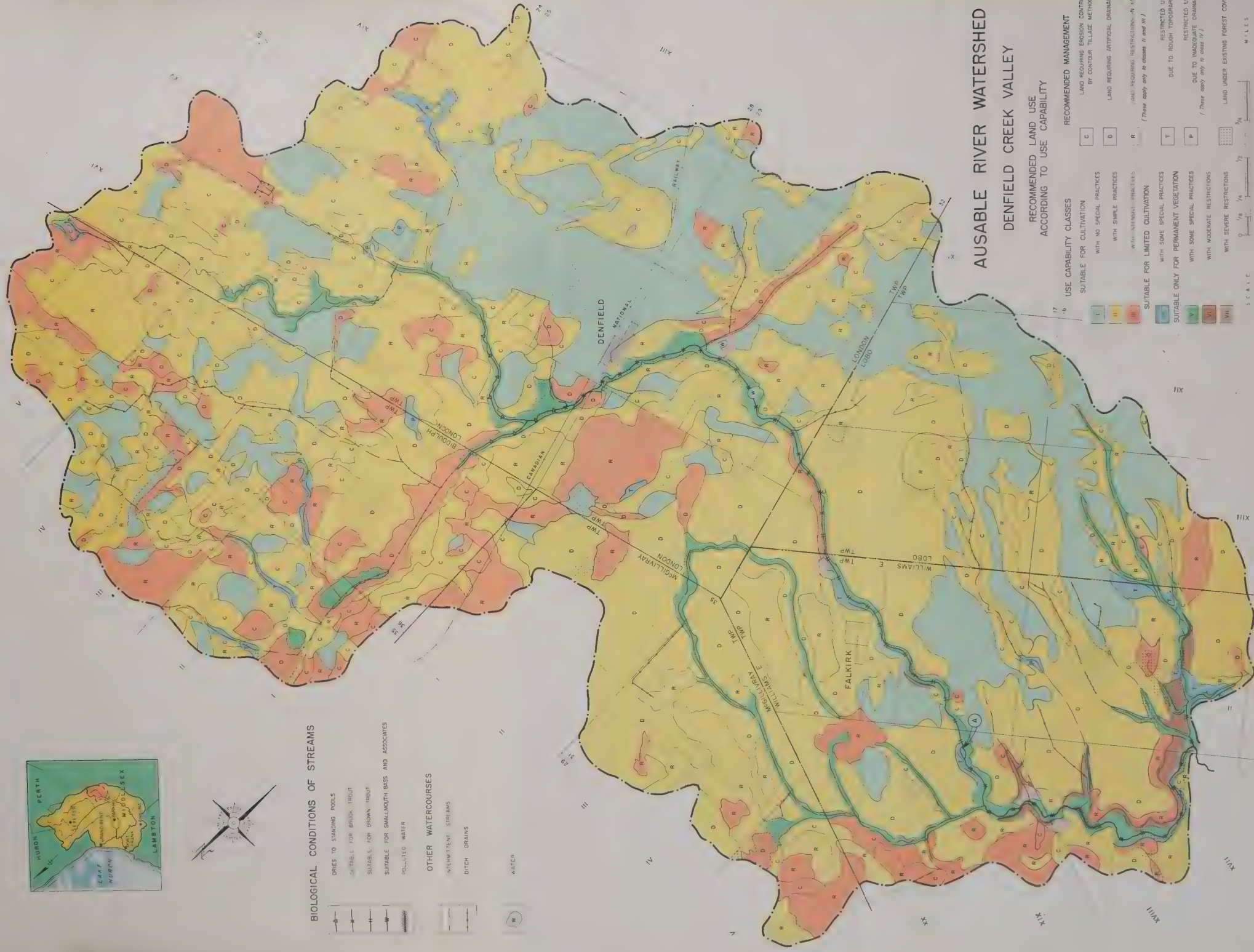


### BIOLOGICAL CONDITIONS OF STREAMS

- DRIES TO STANDING POOLS
- SUITABLE FOR BROOK TROUT
- SUITABLE FOR BROWN TROUT
- SUITABLE FOR SMALLMOUTH BASS AND ASSOCIATES
- POLLUTED WATER

### OTHER WATERCOURSES

- INTERMITTENT STREAMS
- DITCH DRAINS



## AUSABLE RIVER WATERSHED DENFIELD CREEK VALLEY

### RECOMMENDED LAND USE ACCORDING TO USE CAPABILITY

- | USE CAPABILITY CLASSES                 | RECOMMENDED MANAGEMENT   |
|--|--|
| SUITABLE FOR CULTIVATION               | LAND REQUIRING EROSION CONTROL BY CONTOUR TILLAGE METHODS                          |
| WITH NO SPECIAL PRACTICES              | LAND REQUIRING ARTIFICIAL DRAINAGE   |
| WITH SIMPLE PRACTICES                  | LAND REQUIRING RESTRICTIONS - A, A-1, A-2 (These apply only to classes II and III) |
| SUITABLE FOR LIMITED CULTIVATION       | RESTRICTED USE DUE TO ROUGH TOPOGRAPHY   |
| WITH SOME SPECIAL PRACTICES            | RESTRICTED USE DUE TO INADEQUATE DRAINAGE (These apply only to class IV)           |
| SUITABLE ONLY FOR PERMANENT VEGETATION |  |
| WITH SOME SPECIAL PRACTICES            |  |
| WITH MODERATE RESTRICTIONS             |  |
| WITH SEVERE RESTRICTIONS               |  |
| LAND UNDER EXISTING FOREST COVER       |  |

SCALE: 0 1/8 1/4 1/2 3/4 MILES



by mechanical means such as contour tillage, diversion terraces, strip-cropping or buffer strips. Some land susceptible to erosion but capable of being farmed using these methods is also placed in this class.

Land whose surface varies from level to sloping but which is unsuited to contour tillage, although subject to erosion, drought or fertility depletion, may be placed in class R. Hummocky land is usually placed in this category. Vegetative methods of control such as rotations, winter cover crops and soil-building crops are indicated.

Wet land whose productivity can be improved through artificial drainage with minimum difficulty and expense is indicated by the letter R. Class III D requires more intensive application than class II D.

Class IV land may be land too rough or eroded to be put under regular rotation and is indicated as IV T. Land which is too wet for regular rotations and on which artificial drainage is not feasible because of lack of outlet or the expense involved in providing one is classed as IV P. Normally suited only to pasture or forest, land of this class may, however, be cultivated and cropped in a dry year. Class IV P land differs from class V land in that it is not subject to periodic stream inundation.

#### Land Class I

The land designated as class I involves a fairly large acreage - 3,941 acres or approximately 22 per cent of the watershed. It is found on the level and shallow sloping, uneroded or lightly eroded well drained Huron soils. These soils are reasonably fertile, and the land class may be cultivated freely in any regular rotation with no restrictions and no special practices over and above what is considered to be good farming. This means, of course, fertilizing as needed, maintaining the organic content by the incorporation of plant residues, green and barn manure, the suppression of weeds and



so on. Approximately 62 per cent of the land is cultivated, and the large balance is in permanent vegetation or other uses.

#### Land Class II C

About 1/7 of the land has been designated as class II C. It includes chiefly the smoothly sloping, slightly to mildly eroded Huron soils, but a small acreage is found on the Guelph and Burford soils. The slopes range from 2 to 6 per cent, are smooth and are suited to contour methods of cultivation. Where necessary strip-cropping, diversion terraces and grassed waterways may be installed.

#### Land Class II R

This land class takes in hummocky land with slopes ranging from 2 to 7 per cent and smoothly sloping land which is broken by watercourses to the extent that contour cultivation would be impractical. The acreage involved is a little larger than that of land class II C, and again most of it is found on the Huron soils.

Erosion is mild to moderate and may be controlled by extended rotations, the use of winter cover crops and the restriction of intertilled crops, particularly on the more steeply sloping land.

#### Land Class II D

Nearly 1/3 of the watershed has been designated as class II D land, most of it on the Perth soils. The London loam contributes a very small acreage. The land is level to gently sloping and nearly erosion-free. Outlets are available and artificial drainage is recommended - often a single ditch would prove highly beneficial to crops or pasture and in allowing earlier working of the land. Many acres of these soils have been ditched or tilled but some of these measures particularly the latter, are ineffective in their present state.



Land Class III C

Only a minor acreage - less than 2 per cent of the whole - has been classed as III C. All of it is associated with the Huron soils where the slopes range from 6 to 10 per cent or where more gently sloping soils have been so severely eroded that the land must be down-graded from class II.

Land Class III R

Approximately 8 per cent of the watershed area has been classed as III R land. Like the II R, the nature of the land is such that contour methods of cultivation are impractical. The slopes are somewhat steeper generally than on II R land and erosion is more of a problem. In some cases, less rugged land which has been more severely eroded has been placed in this class. Also, some phases of what would normally be considered class III land have been placed in class IV because of the severe erosion.

Intensive restrictions in use are required to prevent more serious erosion and fertility depletion on this land. The use of longer rotations and the growing of the soil-building grasses and legumes are indicated.

Land Class III D

This land class is associated almost entirely with the poorly drained Brookston soil. Drainage is desirable and feasible but would be fairly costly to provide the necessary benefit. When adequately drained and properly managed, the Brookston is a fairly productive soil. The land surface of this class is level to very gently sloping, and erosion is not a problem even under fairly intensive use.

Land Class IV T

Land of this class should be restricted from regular cultivation because of rough topography and susceptibility of the soil to erosion. It is not good land for tractor work. Fortunately, very little of the watershed area is involved - about  $\frac{1}{2}$  of 1 per cent. Land of this class is best



placed under a permanent grass cover with controlled grazing. Occasional cultivation to provide new pasture may be done with reasonable safety. The occasional grain crop may also be grown.

#### Land Class IV P

The acreage defined as class IV P is insignificant - less than  $\frac{1}{2}$  of 1 per cent - and is confined to those wet areas which cannot be economically or feasibly drained. Erosion is negligible and in a dry year, with a lower water table, a crop may be taken off.

#### Land Class V

This type includes those areas subject to periodic flooding, chiefly the flatlands adjacent to the streams. It includes the small muck areas found within the watershed. In most places the land is clear and devoted to permanent unimproved pasture. Elsewhere a tree cover still prevails and should so remain. The benefits to be gained by clearing would be offset by the cost of so doing.

The chief hazard to use is that of poor drainage combined with periodic flooding. In addition, most of the land is so cut up by the streams that it could not be cultivated. In a few places the area is extensive enough that it might be used for field crops in a good year.

Normally the land requires no special conservation practices apart from woodlot protection and pasture management. Also, more consideration should be given to stream and stream-bank protection.

#### Land Classes VI and VII

Taken together these lands make up less than 1 per cent of the watershed area. In both cases the land is steeply sloping and eroded or highly subject to erosion. The land of these classes may be hummocky or smoothly sloping, and is found chiefly along the streams on the valley slopes.

This land is unsuited to any form of cultivation and if left in pasture grazing should be restricted.



In many cases, where woodlots are not already present, reforestation would be the best practice.

In addition to the areas mapped in these classes, there are other parcels too small to be recognized at the scale of mapping. These areas should, if cultivated, be taken out of this use and devoted to grazing or forest.

#### Land Class VIII

There is no class VIII land in the watershed.

Table V summarizes conditions according to recommended use and suggests the acreage of land cultivated, uncultivated and in forest. Most of the land classed as cleared but uncultivated is in pasture, and a number of instances were recorded where pasture had lain for up to 30 or 40 or more years without being broken.

In all classes from III D to VII most of the land is uncultivated, and this reflects either poor drainage conditions or rough topography. There is a fairly good adjustment of use to capability on the land of these classes. On classes I to III a large acreage is not being used to capacity. As indicated earlier most of this acreage is devoted to pasture, a good deal of which has been allowed to deteriorate. Under different management this land is capable of doing much more. This is not necessarily a bad thing from the point of view of the land, of course, because little physical damage to the soil will normally result provided overgrazing of the pasture is not indulged in. The forest land has been separated on the basis that it cannot be considered agricultural land in its present condition. It is interesting to note the distribution of forest with respect to land classes,

A comparison of the valley with the whole Ausable Watershed shows the latter to have a slightly less percentage of land in cultivation, less in pasture and 4 per cent more in forest. The increase of forest is accounted for by the existence of areas such as the Hay Swamp. By and large,



TABLE V

## THE PRESENT LAND USE OF THE RECOMMENDED LAND USE CLASSES

Land Class	Water Acres	Cultivated Land Acres	% of Class	Uncultivated Land Acres	% of Class	Forest Acres	% of Class	Total Acres	% of Total Acres
I	-	2,466	62.6	1,190	30.1	285	7.3	3,941	22.0
II C	-	1,489	57.8	949	36.9	134	5.3	2,572	14.0
II R	-	1,120	40.2	1,375	49.3	292	10.5	2,787	15.0
II D	-	2,722	50.2	2,332	43.0	570	6.8	5,424	30.3
III C	-	267	84.9	46	14.8	6	.3	319	1.8
III R	-	942	66.2	453	31.8	28	2.0	1,423	7.9
III D	-	80	15.8	314	61.9	114	22.3	508	2.8
IV P	-	-	-	58	89.2	7	10.8	65	.6
IV T	-	16	15.0	84	78.5	7	6.5	107	.4
V	-	62	10.6	446	76.4	76	13.0	584	3.3
VI	-	8	7.3	93	84.5	9	8.2	110	.6
VII	-	-	-	39	95.1	2	4.9	41	.2
Water	23	-	-	-	-	-	-	23	.1
Total Acres	23	9,172		7,379		1,330		17,904	100.0
% of Total	.3	51.1		41.2		7.4		100	



however, there is seen to be a fairly close correspondence between the two in so far as broad use of the land is concerned.

TABLE VI  
LAND USE IN DENFIELD CREEK  
AND IN THE AUSABLE VALLEY

Use	Denfield Branch		Ausable	
	Acres	%	Acres	%
Cultivated	9,172	51.1	214,500	50.2
Uncultivated*	7,402	41.5	163,080	38.4
Forest	1,330	7.4	48,300	11.4
Totals	17,904	100.0	425,880	100.0

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\* Includes water, urban and other land uses not of an agricultural nature. The acreage involved is not more than 1.5 per cent of the whole.



## CHAPTER 5

### CONSERVATION PRACTICES

#### 1. Introduction

The people of the watershed are fortunate indeed in possessing such a large percentage of Class I and Class II land. Most of the soil has been eroded only mildly, but this is only part of the story. There are too many fields full of weeds and too many thin pastures. There are too many fields with cracking soils, a witness to organic matter depletion. The improvement of these conditions alone offers a challenge to the farmers of the watershed and to the Authority, which can, through a program of education and through assistance where possible, help to create a better valley than at present exists.

Primarily the area is a livestock and livestock products producing section but as we have seen the land, on the basis of acres per animal, is not carrying the number of livestock it could. In part, this may be due to the run-down nature of some of the pasture, some of which is more the nature of rangeland. The soils and climate of the watershed are able to produce better forage than this. The Dominion Experimental Farms Service suggests that, based on experimental evidence and practical experience, it is possible to carry one or more animal units per acre of pastureland during the grazing season in eastern Canada.\* Because of seasonal variations in the climate, local differences in soil, etc., the actual carrying capacity would normally be less than this. Also, this estimate is based on a well balanced program.

By the use of methods which have been developed over the years by agriculturists and conservation specialists,

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\* In this estimate, 1.0 animal unit is considered to be 1 cow weighing 1,000 pounds and giving 25 pounds of 4 per cent milk per day. One dairy heifer averaging 600 pounds and gaining 1.2 pounds daily would represent  $\frac{1}{2}$  an animal unit.



the lands of this valley could be made to produce more, not at the expense of the soil but through its improvement. The techniques developed aim at the reduction of soil erosion, the improvement of soil-moisture relations, the improvement of soil structure and the provision of better crops and animals.

The improvement of the land on a farm may often be accomplished simply by changing the methods used. What was good enough in father's time may not be good enough today. In other cases more may be required than a simple change of method. Perhaps one or more fencelines should be removed, a line of tile should be placed or some other measure installed. In any case, the aim is increased productivity, better crops and animals, a better land and a saving in time and money. The achievement of these things may require an initial capital outlay but with the expectation that it will be recouped through increased income.

To be assured that he is installing the correct methods and derives the most benefit, the individual farmer should consult the Soil Advisory Service, Ontario Agricultural College, through his local Agricultural Representative, or the Agricultural Representative himself. It will pay the farmer to have his farm planned by farm planners of the Advisory Service.

Although the actual application of most of the measures described in this report will of necessity be on a farm basis, they should so far as is feasible be carried out with the planning of the whole area in mind. The recommendations made here as to land use, as portrayed on the map, are not necessarily applicable to an individual farm. This map was not constructed with the object of planning farms. The recommendations are meant to provide the Authority with a base on which to carry out a program of little valley improvements and indicate where certain measures, as follows, could be used to best advantage. It should be remembered that the



map of recommended use accompanying this report represents an end product after the weighing of many factors.

The following conservation measures are a few of the more important ones which might be used to advantage in the watershed. There are others which would find application in specific cases.

## 2. Conservation Measures.

### (a) Contour Cultivation and Strip-Cropping.

Contour tillage means the cultivation of land along the contour and at right angles to the slope. Easily contoured slopes are broad and smooth and possess a minimum of slope change or of surface drainage channels. The best installation of such measures may require the removal and/or relocation of one or more fencerows. When the land is tilled "on the level" each furrow or drill-row acts as a small dam to retain the run-off water, which is better able to be absorbed by the soil. It may not be possible to follow the contour exactly, but this should be done as nearly as possible. If the furrows or drill-rows are not on the line of contour, there is the danger of water accumulating in depressions behind the implement-formed ridge and breaking across it to cause rill or gully erosion. This may be overcome by careful tillage and by providing grassed waterways in normal drainage channels.

Strip-cropping is often carried on in conjunction with contour tillage. This involves the establishment of alternating crop strips across the slope. Some strips would be devoted to grain or intertilled crops, and the strips between would be in hay or pasture. By the use of such a practice any water which escaped from the cultivated strip and which carried soil with it would be checked by the grass strip, with the result that the soil load would be dropped.



Within the watershed close to 16 per cent of the land has been considered suitable for contour work. Most of this is on the soils mapped as Huron clay and Huron silt. There is no doubt, also, that some of the gently sloping Perth soil would be well suited to these measures. On this soil, however, drainage is the primary need.

(b) Improved Pasture.

"If Ontario is to replace imports (from Western Canada) with home-produced cattle at least 100,000 beef cows must be added to our herds. It would be unwise to attempt such an increase without considering the feed requirements of these extra cattle. Furthermore it would be poor economy to import the additional feed when thousands of acres in this Province are not producing to capacity.

"...improved pastures provide the best answer to the problem of increasing feed supplies...by stepping up the carrying capacity of pastures some of the land that is now in grass could be released for the production of winter feed." \*

Several of the things brought out in the above quotation are applicable to the present watershed. In this area the answer is not to be found so much in the provision of more grass acreage but in the provision of better grass.

Because such a large proportion of farm income in this province is derived from the sale of animals or animal products, pasture should never be considered a "poor relation" in the farm economy, but unfortunately this is often the case. Frequently pasture is relegated to the poorest of the land and little or nothing is done to improve the carrying capacity. Where good land is so used, the same is all too often true. The number of beef or dairy cattle or sheep that a farm may carry is directly related to the

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\* Lower the Cost of Beef Production. Circular 163, Ontario Department of Agriculture. November, 1952.



quality of the pasture. Pasture is a major land use, not a minor one, and should be so treated.

Over most of the watershed the land is suited equally to pasture or crops. One major factor restricting both is that of inadequate internal soil drainage. A wider variety of pasture grasses and legumes may be grown where the drainage is improved, and this may be done through tiling or ditching. Where measures of this kind are not indulged in, better, more nutritious pasture may be obtained by sowing species tolerant of the damp conditions. Better pasture may also be obtained through judicious application of commercial fertilizer, the control of weeds and the spreading of droppings. With reference to this latter point, much of the manure produced by cattle on pasture is poorly distributed under shade trees and along fence-rows and streams. Even on the open pasture it is irregularly and poorly distributed, and of course its efficiency is reduced. One investigation has shown that the average cow excretes about 3 pounds of urine at a time over a spot about 2 feet in diameter. When considered in terms of fertilizing value, this represents approximately 5,560 pounds of a 10-.1-11 fertilizer per acre. The unappetizing flavour of this excessively rich nitrogen-potash grass is a suggested reason for the refusal of cattle to eat it.

Although these facts and presumptions apply specifically to urine as manure, the same is relatively true for solid manure. Again the distribution is haphazard, grass is covered and small plots receive excessive amounts. Occassional harrowing of

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\* For amplification of this see: Midgley, A.R., and Varney, K.E. Potash Losses on the Dairy Farm: Better Crops with Plant Food Magazine, April, 1946.



the pasture will spread the droppings, thereby making fuller use of their fertilizing value and make the pasture more agreeable to the animals.

Some pastures may have been in for so long and have been so grazed that it would be desirable to reseed the land. Specific recommendations for the preparation and seeding of pastures may be obtained from bulletins distributed by the Departments of Agriculture.\* Soil tests and the use of fertilizer should not be neglected in the building of better pasture. Further, it should be realized that the quantities and types of seed to be used will depend on the type of soil in the field and the use of the pasture.

Management after seeding is important in maintaining a high level of production and in ensuring that the best possible return is obtained after the expense of working, seeding and fertilizing. Outlays of this sort will probably be recouped only after three or four years, but beyond that time a higher return will be gained than if the pasture was unimproved. Periodic clipping helps to produce a thicker turf and a more even stand and inhibits the growth of weeds. A further factor in pasture management is that of ensuring, so

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\* Useful bulletins include:

- (a) Guide to Crop Production in Ontario. Extension Bulletin No. 68, Ontario Department of Agriculture.
- (b) Hay and Pasture Mixtures for Ontario. Circular No. 239, Ontario Department of Agriculture.
- (c) Better Ontario Pastures. Bulletin No. 469, Ontario Department of Agriculture.
- (d) Fertilizers for Cereal, Hay and Pasture Crops. Circular No. 144, Ontario Department of Agriculture.
- (e) Beef Husbandry in Ontario. Bulletin No. 509, Ontario Department of Agriculture.
- (f) Better Pastures in Eastern Canada. Publication No. 809, Farmer's Bulletin No. 150, Department of Agriculture, Ottawa.



far as is possible, that no over- or undergrazing takes place. The important question of weed control and shrub removal has been mentioned in a previous section and is one with which the Authority might consider concerning itself.

There is also a small amount of pasture within the watershed which could be improved only with difficulty, if at all. Land of this sort is either too rough or too wet. It is best left as it is, but caution should be exercised in its use. In some places the land would be better reforested.

(c) Artificial Drainage

Of all the measures which might be applied to the soils of the watershed to make them more productive, that of artificial drainage is one of the more important. As may be seen from the figures in Table I, almost one-half of the land in the watershed suffers drainage imperfections of greater or lesser severity. This has been recognized and over the years steps have been taken, by means of underdrainage and open ditching, to improve matters. It seems certain, however, that much may yet be done in this regard. Often the drainage measures installed are insufficient or inefficient or simply not working. Where open ditches are installed, and this may mean simply the straightening and deepening of an existing watercourse, they should be properly constructed and maintained to be effective. If tile underdrainage is placed, the outlet should be protected; many gullies have started from inadequately protected outlets. The benefits to be derived from improved drainage are immediate and tangible and the Authority might well consider backing, to the extent of its power, a campaign of improvement.



To provide good outlets, the last few feet of tile drain should be of vitrified tile or corrugated metal pipe extended a few feet out into the ditch or stream. A head wall to prevent back-cutting and an apron to prevent scouring and gully development should be provided. The open end should be screened to prevent the entry of animals.

Ditches should be provided with gentle side slopes to prevent slumping and the spoil banks should be spread out. Spoil banks left in the rough are unsightly, are unproductive and harbour weeds. So far as is possible, ditches should be fenced from cattle to prevent trampling, sedimentation and bank destruction.

(d) Crop Rotations and Cover Crops

All of the well drained or drainage-improved cultivable land on the watershed should be managed using crop rotations suited to the soils and needs of the individual farm. Carefully planned crop rotations, skilfully carried out, constitute a major soil conservation measure. As mentioned previously, there is a definite need for improvement of this kind on the watershed.

A good rotation makes the best use of the soil and is so designed that there is ample return of organic matter, either as green manure or as crop residue. The inclusion of legumes leads to an increase in the nitrogen content of the soil and provides much organic material.

Rotations should be worked out so that the land is kept under vegetative cover as much as possible. By so doing the soil is not so easily compacted and eroded by heavy rains and melting snow. Where it is planned to leave a field fallow, it is advisable to cultivate so that much of the crop residue is left on the surface.



The cropping program will vary from farm to farm and will depend on the farmer's needs and the soil. The rotation may be arrived at independently by the farmer and may be quite satisfactory, but greater assurance may be obtained by having a farm plan.

(e) Grassed Waterways and Diversion Terraces

Diversion terraces are broad, shallow trenches constructed across a slope to carry water safely to a disposal area. On long smooth slopes these are useful in reducing erosion through excessive run-off. They are best maintained in grass.

In many places natural waterways cross a slope, and in the spring or after a heavy rain they may carry a considerable volume of water. Often, in fact usually, such a channel is cultivated with the rest of the field and receives no protection. This situation is ideal for gully development, and once started their growth may be rapid. Where such a course enters more level land at the bottom of a slope, considerable material may be deposited and a delta formed and the growth of crops restricted.

When such a channel is grassed, it is placed in permanent sod, with the strip wide enough to take care of any foreseeable water flow. The permanent sod reduces the speed of flow and the erosive action of the water and, if large enough, could be used as a source of hay or pasture. Grassed waterways greatly reduce the risk of gullying and they could be installed with benefit at many places.

(f) Farm Ponds

Little need be said about farm ponds on the watershed. Many have been installed in the past year or so as a result of public interest and an aggressive policy of encouragement and aid on the part



of the Ausable River Conservation Authority. The Authority is to be commended for the part it has played in the construction of ponds in the valley, Greater emphasis might be placed, however, on better construction and maintenance. The spoil banks should be spread and seeded, and the pond should be fenced to prevent trampling.



## CHAPTER 6

### FOREST AND WILDLIFE CONSERVATION

#### 1. Forest Conservation

The watershed of the Denfield Creek contains no large swamp or submarginal areas which are in forest or which might be recommended to the Conservation Authority for public reforestation. It is not surprising in such an area of good agricultural soils that only 5.6 per cent is now in forest compared to 11.7 per cent for the Ausable Watershed as a whole. There is some room for forest expansion in wet or rough areas, mainly those designated as class VI or class VII on the land capability map. Scrub growth - willow, hawthorn and other non-commercial species - covers 2.1 per cent of the watershed and should be replaced with productive forest wherever the land cannot economically be reclaimed for agriculture. Assistance from the Ausable River Conservation Authority is available in planting these areas to trees. It would be much better to have planting done as part of an overall farm plan than simply as an isolated small project.

More serious than the low percentage of woodland is the poor management of those woodlots which do remain. Over 76 per cent of the woodland is pastured. It is safe to say that it is neither good pasture nor good forest. Grazing destroys the natural regeneration, exposes tree roots to injury and disease and reduces the absorptive capacity of the soil. On the other hand, it is interesting to note the findings of the Wisconsin Agriculture Experiment Station,\* which measured the total yield per acre of dry matter from three types of pasture over a five-year period in Richland County.

Improved pasture (grass and legume)	3,210 pounds
Unimproved open pasture	1,453 pounds
Woodland pasture	276 pounds

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\* The Case Against Cows: Wisconsin Conservation Bulletin, December, 1951.



Here the improvement of one acre of open pasture provided a gain of 1,757 pounds of feed, which is equivalent to the forage from 6.4 acres of woodland producing at the rate of 276 pounds per acre. At a similar rate the improvement of 120 acres of existing open pasture would provide more added roughage and better quality fodder than the present 761 acres of pastured woodland, and the woods could be freed of their present scourge..

Where a woodlot exists or is contemplated, an outline of proper management, including protection from grazing, should be obtained from the local office of the Department of Lands and Forests for inclusion in the farm plan.

## 2. Stream Conditions

The Denfield Branch of Nairn Creek is approximately eight miles long, and has a fairly high gradient (at least 15 feet per mile). About 35 per cent of the stream course was considered to be "rapids". The gradient is highest from Denfield to Falkirk and for two miles below the latter centre.

Apart from two streams near Denfield, all the tributaries were dry when examined in July, 1955. There is very little shade along the greater part of the stream, and along several miles less than one per cent of it is shaded. The stream passes through three woodlots, one near Denfield, one below Falkirk, and a hawthorn scrub area near its junction with the main Ausable River. Most of the land adjoining the stream is pastured, but the woodlots above Denfield and below Falkirk are protected from cattle. Since the bottom is mostly rocky and cut-banks are infrequent in the upper sections, there is little damage from trampling of the banks in these sections. In the lower course, with more cut-banks occurring, cattle effects are naturally greater.

Most of the stream course lies in a relatively shallow valley, which becomes steep-sided (50 feet) only near the mouth. The high water mark progresses from about 1 foot



to about 5 feet from the source to the mouth. Sedge meadows border the stream above Falkirk with some extensive cattail stands near Falkirk and Denfield.

Near Denfield two small spring-fed streams enter the main stream and apparently there are springs in the bottom of the creek. Although there has been little attempt to manage the stream for fishing, it produces legal sized trout in the area immediately above and below Denfield, brown trout below Denfield and legal sized smallmouth bass in the remainder of the stream below this section. The presence of brown trout in the area below Denfield and the fact that they occur down to the point A on the accompanying map poses a special problem. It is now well understood that although brown trout and speckled trout have approximately the same lethal temperature (i.e. they will die if exposed to the same water temperature (say 83° F.) for any length of time), brown trout have a higher optimum temperature than speckled trout. This means that they will thrive in water at a higher temperature nearer the lethal limit than will speckled trout. Brown trout tend to be predators of speckled trout. For the best management of this stream it seems that either brown trout should be excluded from the area above the Denfield Dam, but might be introduced below it; or the whole stream might be managed for brown trout. The temperature of the water at which brown trout were found to be thriving at the point A was 73°, which is far above the ideal temperature for speckled trout but is not much above the best conditions for brown trout. The only area fished intensively is that around the pond near Denfield. This part of the pond is posted against trespass.

In the lower two and a half miles of stream the water becomes turbid and a milky curd was found in the backwaters. The location of this pollution was not determined.

The creek was extremely rich in fauna with both a large number of species and a very large fish population.



Schools of minnows were seen in close proximity with 15-inch brook trout and 12-inch smallmouth bass. Twenty-four species of fish were collected in the stream while it was being examined. The suitability of the various sections for different fish species is shown on the accompanying map. The creek chub and common sucker were found at all seven collection stations. The other fish of special interest were brook trout (at two stations), brown trout (at two stations), smallmouth bass (at three stations), and rock bass (at two stations). These species were also seen but not collected at various other places. (The main stream was walked from one end to the other. The detailed field notes are available for reference.)

### 3. Stream Improvements

The sides of the stream are lined for much of their length with sedges. This of course reduces the occurrence of cut-banks. In the broader riffles, which are relatively frequent, the larger rocks (2 feet in diameter) lying in the stream bed could be used for rock deflector dams. There is a great lack of fish cover in the stream, and more pools are certainly needed. Over about a quarter of the stream course these could be made with anchored log dams. At many other points by-pass ponds could be constructed.



## CHAPTER 7

### IMPROVING THE VALLEY

The valley described in this report is entirely rural and there is not the conflict of land uses comparable to that found in many parts of the province. The area is sufficiently insulated by distance from the city of London and consequently from any of the direct developments arising out of the growth of that centre. The same is true respecting the lesser communities in this region. It appears highly unlikely that the present situation will change greatly in the foreseeable future.

Therefore, any program of valley development which the Authority and the people of the valley may undertake will not be beset by the problems stemming from industrialization and urban growth so common to many areas. The job to be done is thus simplified considerably.

The effectiveness of any efforts of planning the better use and improvement of the watershed will depend on the volunteer and co-operator to a large extent. Soil and water conservation is carried out on the land and is, therefore, in the hands of the farmers. The needed adjustments in land use may be reached through the application of farm planning. Each farm within the watershed should be planned. The Authority is therefore urged to do all that it can through publicity, education and leadership to have farmers on the watershed avail themselves of the services of the Soil Advisory Service and to carry out the recommendations of the plans.

Further in this matter it is suggested that the Authority consider employing a man for a summer, or longer if need be, whose responsibility it would be to contact each farmer on the watershed. At this time the benefits to be derived from a farm plan would be pointed out and his co-operation requested. It is likely that on most farms more than one visit would be necessary.



Periodically the progress made should be reviewed and publicized at a public meeting or in any other way convenient and the degree of Authority assistance and participation made known. The program would, of course, be carried out in co-operation with the County Agricultural Representative who would arrange to have the farm plan surveys made, and with the Zone Forester concerning woodlot management and reforestation.

The Authority has promoted farm pond construction not only in this valley but throughout the Ausable Watershed and is to be commended for its efforts. It is felt, however, that more consideration should be paid to the better construction and maintenance of these ponds. Fencing and other measures will enhance their value and promote a longer life.

There are other improvements which may be carried out in the valley under the sponsorship or direction of the Authority or of other groups, such as the Scouts, Angling Clubs and so on who might co-operate with the Authority. Stretches of the stream might be improved as suggested in the section of this report dealing with stream conditions. There are gullies which should be controlled, particularly along the stream, grassed waterways which might be installed, and scrub-covered pastures which should be cleared and renovated. The Authority might, perhaps, consider supplying machinery for pasture clearing where the farmer is unable to do the complete job himself.

Essential to a successful soil and water conservation program is an understanding of the land itself. Most farmers are able to judge reasonably the quality of their livestock, poultry and crops simply because they have a reasonable understanding of them. There is no reason why they should not be as successful in estimating the quality of their land and of knowing with more assurance the qualities which go to make up good and poor land. Familiarity of this



sort breeds understanding. Anything that may within reason be done to bring to the people of the watershed a better understanding of their land will be worthwhile.

For this reason it is suggested that the Authority consider a program of land judging contests with particular reference to the Little Valley. The Humber Valley Conservation Authority has engaged in this work, with the co-operation and help of the County Agricultural Representatives and the Soils Department of the Ontario Agricultural College, and the results have been most gratifying.











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Gov.Doc Ontario. Planning and Development, Ont Department of P Denfield Creek plan, 1956.	
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